

Transnational Contagion and Global Security

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SINCE THE END of the Cold War, the United States is increasingly accepting its role in global security as one of securing peace and prosperity through efforts directed toward states that are failing or at risk of failing.¹ Even if these states do not pose a direct military threat, their failure clearly has a ripple effect well beyond their borders. Recent history and current events point to national tragedies in places such as Somalia, Rwanda, Haiti, Bosnia and some of the newly independent states of the former Soviet Union. In many of these places the universal human value of widespread good health is lacking, with obvious effects on productivity and contentment. Contrary to traditional Malthusian thinking, poor health is also associated with uncontrolled population growth.² Such growth typically leads to migration and the creation of the dense urban slums now found in so much of the developing world. These circumstances in turn lead to the conditions that foster the emergence of new infectious diseases, some of which, due to their epidemiologic characteristics, threaten the very fabric of nations and even humanity.

President William J. Clinton's national security strategy of engagement and enlargement and former Secretary of Defense William J. Perry's doctrine of preventive defense take a broadly defined, proactive approach to securing global stability.³ The concept that some infectious diseases are national as distinct from international is outdated. In an era in which business and recreational travel, environmental change and population migrations occur on a global scale, it is unrealistic to think that national borders can secure the United States from infectious disease threats or their consequences. The international importance of emerging infections has been reflected in discussions among the world's most senior leaders, including those of the G7, the US-European Union New Transatlantic Agenda, the Gore-Chernomyrdin Commission and the Gore-Mbeki Commission. During the 1997 Denver summit

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the United States presented a major infectious disease initiative that included a commitment from the heads of state to develop a global surveillance system.

The Problem

Throughout human history, infectious disease epidemics and pandemics have affected not only the health of individuals but also the success of military operations and even the stability of societies. Despite tremendous public health progress during the 20th century, numerous infectious conditions have grown harder to control, and some new infectious diseases have emerged. To public health leaders, the optimism or indifference displayed toward infectious diseases poses a threat to society.

Because of readiness demands and the particular environments in which military personnel train and deploy, this concern is especially important to the services. The fact that recruits from throughout the country mix closely in basic training camps and later travel and mingle extensively with persons throughout the world favors the appearance and rapid spread of emerging infections in the military. The fact that our troops tend to grow up under good hygienic conditions further means that upon reaching adulthood they tend to be "immunologic virgins" compared

with members of many potential opposing forces who spent their childhood in hygienic squalor. As a result, some infections, to which our opponents may have almost universally become immune dur-

Some recent operationally significant infection problems affecting our troops have included an outbreak of primaquine-tolerant vivax malaria after operations in Somalia, dengue fever during and after operations in Somalia and Haiti and the resurgence of malaria along the DMZ in Korea. Outbreaks of drug-resistant Campylobacter diarrhea have also affected troops deployed on recent exercises in Thailand and Greece.

ing childhood, can pose a significant health threat to a deployed US force. The military effect of differential immunity was well illustrated in the colonization of the New World: small numbers of European explorers had a relatively easy time conquering native forces because indigenous populations were highly susceptible to deadly manifestations of what were, for the Europeans, commonly occurring illnesses such as measles and smallpox.⁴

The term "emerging infectious diseases" is usually applied to those conditions in which the incidence in humans has increased within the past two decades or threatens to increase in the near future.⁵ The concept of emerging infectious diseases, however, can equally apply to animals or plants. Certainly the impact of the fungus *Phytophthora infestans* on the Irish potato crops in the late 1840s left a lasting impact on not only that island but also the rest of the world. More recently, the 1997-98 El Nino-associated outbreak of Rift Valley Fever in East Africa killed tens of thousands of domesticated animals, a huge threat to stability in a region where the health of these animals is key to human survival.

The reemergence of plague in India in 1994, though probably less significant than originally thought, still prompted the frantic migration of over 300,000 frightened refugees, some of whom allegedly carried the bacteria. The fear prompted the closing of borders, the cessation of trade and a significant tumble on the Bombay stock exchange. Ultimately, even a military quarantine was put into place and the possibility of bioterrorism emanating from another country was officially investigated.⁶

Even unsubstantiated rumors of emerging infections can do great damage to the fragile economies of some countries as was evident when in 1996 the Dominican Republic lost millions of dollars in can-

celed tourist travel after the erroneous report of Ebola hemorrhagic fever on the island.

Emerging infectious diseases have taken a major toll on the US military during both training and operational deployment. Some recent operationally significant emerging infection problems affecting our troops have included an outbreak of primaquine-tolerant vivax malaria after operations in Somalia, dengue fever during and after operations in Somalia and Haiti and the resurgence of malaria along the demilitarized zone (DMZ) in Korea.⁷ Outbreaks of drug-resistant *Campylobacter* diarrhea have also affected troops deployed on recent exercises in Thailand and Greece. In the 1980s and 1990s two previously unknown tick-borne diseases, human ehrlichiosis and South African tick typhus, emerged in outbreak dimensions among deployed US troops.

The most worrisome known potential emerging infectious disease threat is that of pandemic influenza. A highly transmissible variant of the H5N1 avian influenza that occurred in 1997 in Hong Kong and killed 33 percent of those infected would be catastrophic to national and international security.⁸ The Wuhan strain of influenza A, which recently emerged and circulated around the world, was first recognized outside of China in a US Air Force health care beneficiary. This emerging strain was considered so important a threat that the World Health Organization recommended its inclusion in influenza vaccines used worldwide during the past two years. Unfortunately, in February 1996, before a vaccine could be made incorporating the Wuhan strain, an outbreak occurred on the USS *Arkansas*, affecting 217 of the 526 crewmembers over a three-week period. This sickness from a relatively benign strain of influenza forced the ship into port for two days.

The threat of emerging strains of influenza to military populations is not new. The US military was affected early during the infamous 1918-1919 influenza pandemic that killed more than 20 million people worldwide including more than 43,000 US military personnel.⁹ During mid-October 1918, the US Army and Navy experienced over 6,000 influenza-related deaths per week, largely in recruit camps. In spite of the ongoing World War, this outbreak necessitated suspension of about 143,000 inductions into the service. The effect on the Germans was also significant: the thousands of cases in German divisions during the summer of 1918 greatly weakened the German's capability to mount a successful offensive against the Allies. Some historians credit this epidemic and its impact on the German forces with contributing significantly to the end of World War I.¹⁰ The memory of this catastrophic pandemic helped mobilize the United States in 1976

after a recruit died from swine influenza at Fort Dix, New Jersey.

Factors in Emergence

Disease emergence depends on many factors.¹¹ Genetic changes may be responsible for the emergence of new infectious diseases from existing organisms, such as influenza. Known diseases may spread to new geographic areas and populations, as has been observed with raccoon rabies in the northeastern United States. Previously unknown infections may occur when humans enter certain environments that increase exposure to insect vectors or environmental sources of new agents. Activity in once-remote tropical rainforests is an example of how humans might come into contact with previously unknown infectious agents. Breakdowns in public health measures for previously controlled infections have also contributed to the spread of more well-known illnesses such as cholera and whooping cough.

Societal disruption (such as, urban decay, refugee migration and economic impoverishment) may lead to the emergence or re-emergence of infectious diseases. The huge problem of diarrhea due to cholera and shigellosis in Zaire among Rwandan refugees is a graphic example. Social disruption in North Korea may explain the reemergence of malaria after a 20-year absence on the Korean peninsula immediately south of the DMZ. The current malaria emergence began in 1993 with only two reported cases but quickly grew to 39 cases in 1994, 118 in 1995, 367 in 1996 and 1642 in 1997. The US military reported 27 cases in 1997, but owing to the long incubation period of this malaria species, cases turned up in troops who redeployed to the Continental United States. Some of these ill individuals presented only after leaving the military. Though local spread from these soldiers into US populations has not been documented, in recent years local transmission from malaria-infected migrants has led to indigenous malaria

cases in Michigan, Virginia and California.

Advances in health care also contribute to the development of emerging infections. In addition to the effects of drugs causing immunosuppression, the widespread and unrestricted availability of antibiotics in much of the world is an important cause of drug-resistant infections. The concern is not only the acquisition by US forces of antibiotic-resistant organisms while receiving health care during operations overseas but also the importation of these infections to US health care facilities. As a result of antibiotic misuse and insufficient progress in antibiotic development, some forms of tuberculosis, malaria and other organisms that occur overseas are now almost impossible to treat. This problem is increasing.

As even a casual visit to a US supermarket will indicate, Americans consume food that is grown, processed or packaged throughout the world. Processing and packaging associated with a global food

US Coast Guard



Haitians wait for transportation back to their villages after repatriation from the United States.

Disease clearly contributes to the destabilization of states. The United States and partner nations are often called to intervene and bring order to some of these states in collapse. For example, refugees from Haiti, many of whom have been infected with HIV and tuberculosis, have posed a US security concern. The US deployment to Zaire and Rwanda was greatly motivated by the rampant illness among refugees. Emerging infections over the past decade in Somalia, Sierra Leone, Liberia, Burundi and Cambodia have also affected internal stability.

supply have increased the occurrence and spread of emerging infections, such as the recent US cyclosporal diarrhea caused by raspberries imported from Central America. Even more ominous have been the tremendous anxiety, international tension and agricultural embargo associated with the emergence of new variant Creutzfeldt-Jakob disease (Mad Cow Disease) in consumers of British beef.

Over the last several decades Americans have greatly increased their international travel and

Some medical historians believe that the 1918 strain of pandemic influenza was first recognized at Fort Riley, Kansas, and was initially carried on its way around the world by deploying US servicemen. More recently . . . some countries barred US personnel unless it was certified that they had tested negative for HIV. After the Gulf War, US forces were forbidden to donate blood because some had apparently become infected with a previously unrecognized form of leishmaniasis.

changed their sexual behavior patterns. These and other changes in human behavior (including the increased use of child-care facilities and certain recreational pursuits) increase the risk of acquiring emerging infections. American service personnel reflect these behavioral factors and have undoubtedly come back to our shores with foreign-acquired, drug-resistant sexually transmitted diseases.

Global warming, deforestation, floods, drought, famine and other ecological factors also affect the emergence of infectious diseases. Decay in public health infrastructure is another contributor. Communicable disease surveillance systems are inadequate in this country and almost nonexistent in some parts of the world. Better surveillance might have allowed the Human Immunodeficiency Virus (HIV) to be recognized earlier. Of course microbes themselves have an uncanny ability to adapt to changing circumstances. Thus, even without the other factors, humanity will likely never be spared the need to respond to the challenge of emerging infections.

Current and Future Trends

The threat of naturally occurring emerging infections is likely to continue well into the future. Most of the factors in disease emergence described above will take years to mitigate even if countries get organized and motivated. Certainly, some factors such as population growth, migration into minimally inhabited regions and international trade in food-

stuffs will likely continue even in the face of proactive governments. The ability of microbes to adapt will never cease.

Just over the last 25 years at least 25 significant new infectious diseases have been recognized including HIV, multiple-drug-resistant tuberculosis, E. coli O157:H7 diarrhea, Nipah virus, cyclosporiasis, H5:N1 influenza, variant Creutzfeldt-Jakob disease, vancomycin-resistant staph, ebola hemorrhagic fever and hantavirus pulmonary syndrome in the Four Corners area of the US Southwest.¹² Many of these diseases defy treatment or a sure means of prevention. Particularly worrisome is the fact that some organisms are now showing resistance to all known antibiotics. The pharmaceutical industry is not able to keep pace with this trend by developing enough new drugs. Some of these untreatable agents are largely confined (at least for the moment) to isolated parts of the world (for instance, multiple-drug-resistant malaria along the Thai-Burmese border). Others though, such as multiple-drug-resistant tuberculosis, are now found in metropolitan areas of the United States. A new, highly transmissible form of tuberculosis has also recently emerged.

As noted previously, pandemic influenza is unpredictable with respect to its timing but not its inevitability. Pandemics of varying intensity and morbidity have occurred this century in 1918, 1957, 1968 and 1977. Most experts feel it is only a matter of time before a highly pathogenic strain such as the 1997 Hong Kong avian influenza genetically mixes with a more typical, milder, but highly transmissible strain. This could produce a "superinfluenza" reminiscent of the 1918 influenza, which traveled around the world in just months, killing over 20 million people, most in the prime of life.¹³

In recent history HIV is probably the most widely publicized emerging infection.¹⁴ Despite 15 years of research into its epidemiology and control, transmission continues at a high rate in much of the world. The Harvard-based Global Acquired Immunodeficiency Syndrome (AIDS) Policy Coalition estimated in 1996 that 4.7 million new HIV infections occurred globally during 1995. The Policy Coalition further reported that "If the current epidemic trends persist through the end of the century, it is most likely that between 60 million and 70 million adults will have been infected with HIV by the end of the year 2000."¹⁵ About half of these will have been in Southeast Asia and 40 percent in sub-Saharan Africa. The HIV pandemic has had secondary effects on the spread of opportunistic infections such as tuberculosis.

In parts of Africa HIV infection among adults exceeds 25 percent. The loss of productivity, the devastation to family structures and the extent of

premature death have only begun to be appreciated because of the decade-long incubation period before HIV infection progresses to AIDS. In the communities affected, this disease is obviously associated with great psychological stress due not only to personal losses but also the impact of the infection on migration patterns, community leadership and institutions.

Impact on US Security

Traditionally, national security has been defined by most as focused on classical military threats. Our foreign policy interests clearly go beyond the ability to crush the enemy on the battlefield. In the late 20th century, the survival of states is clearly affected by forces well beyond the ability to wage war, as the former Soviet Union's fate illustrates. Just as economic growth and democratic stability throughout the world favor US security, economic collapse and governmental instability in other nations can produce a ripple effect or even a tidal wave against peace and prosperity in this country. In a global economy characterized by growing trade and travel, the United States cannot prosper as a healthy island in a sea of uncontrolled infectious diseases. As President Clinton noted, "New diseases, such as AIDS, and other epidemics which can be spread through environmental degradation, threaten to overwhelm the health facilities of developing countries, disrupt societies and stop economic growth. Developing countries must address these realities with national sustainable development programs that offer viable alternatives. US leadership is of the essence to facilitate that progress. If such alternatives are not developed, the consequences for the planet's future will be grave indeed."¹⁶

Both directly and through its associations with migration, environmental degradation, and other factors, disease clearly contributes to the destabilization of states. The United States and partner nations are often called to intervene and bring order to some of these states in collapse. For example, refugees from Haiti, many of whom have been infected with HIV and tuberculosis, have posed a US security concern. The US deployment to Zaire and Rwanda was greatly motivated by the rampant illness among refugees. Emerging infections over the past decade in Somalia, Sierra Leone, Liberia, Burundi and Cambodia have also affected internal stability.

Specific Impact on US Military Capabilities and Missions

Emerging infections have had a well-established impact in the last decade on US military personnel. The impacts have been not only direct assaults on health but also on policies and missions. As noted

previously, the impact of influenza on military readiness is legendary. A manufacturer's business decision caused the recent loss of adenovirus vaccines, which have been used with great success in US military recruits for 20 years. The absence of vaccines

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will likely lead to thousands of acute, seasonal cases of respiratory disease. Quite possibly such outbreaks will affect our ability to fulfill training quotas as they did at times in the pre-vaccine era.

Many other outbreaks have affected US forces in recent years and will likely continue to do so. Vivax malaria appears to be spreading through the Korean peninsula. Fortunately it is drug sensitive, but its occurrence has caused US troops in Korea to be placed on antimalarial drugs for the first time in over 20 years. The US mission to Somalia several years ago was marked by hundreds of cases of dengue and primaquine-tolerant vivax malaria. Under the right tactical circumstances, such illnesses could have a significant effect on military capabilities, especially when key individuals are incapacitated. Fortunately, effective personal protective measures are available, though they are usually underutilized. Even in the United States, some training areas are becoming more dangerous as a result of the increasing prevalence of arthropod-borne infections such as ehrlichiosis and Lyme disease.

Emerging infections may have significant impacts on how the US military is allowed to operate. Troops have long been considered vectors of emerging infections. In fact, some medical historians believe that the 1918 strain of pandemic influenza was first recognized at Fort Riley, Kansas, and was initially carried on its way around the world by deploying US servicemen. More recently, US servicemen were alleged to contribute to the international spread of HIV infection. Some countries barred US military personnel unless their commanders could certify that they had tested negative for HIV antibodies. After the Gulf War, US forces were forbidden to donate blood because some had apparently become infected with a previously unrecognized form of leishmaniasis. The potential for international

spread of emerging infections by military forces is illustrated by the increasing role of multinational forces on peacekeeping missions. For example, during the UN Haiti mission, four deployed Bengali soldiers incubating hepatitis E acquired at home became ill and potentially could have spread this newly recognized virus. Hepatitis E is a relatively rare agent in this hemisphere but one which is apparently rather common now on the Indian subcontinent.

Almost every major US military mission in recent years has been influenced by the presence of ill health in the local population. As our nation seeks to lead through engagement and enlargement it seems inevitable that deployments to unstable, disease-ridden places like Somalia, Haiti, Liberia and Rwanda will continue. Growing chaos in failing states, often fueled by rampant ill health, will likely lead to more US military interventions. In some of these interventions, US forces may be quite vulnerable. For example, effective antimicrobial prophylaxis and treatment of malaria near refugee camps along the Thai-Burmese border is now almost impossible.

Historians in the next millennium may find that the 20th century's greatest fallacy was the belief that infectious diseases were nearing elimination. The resultant complacency has actually increased the threat. Both naturally occurring and bioterrorist infectious agents hold an increasing potential to destabilize international security. Failure to recognize and accept this concept will lead to disaster. Viewing national security as merely an issue of relative

military capabilities is shortsighted. The underpinnings of most stable societies are increasingly dependent on their populations' health, which is in turn affected by environmental, economic and educational factors.

Globally, infectious diseases remain the leading cause of death. The ability of microbes to adapt and breach our traditional defenses, coupled with changes in society, technology and the environment, sustain the likelihood that epidemics reminiscent of the worst in history will recur. In addition, terrorists with some expertise in molecular biology and modest financing can now wage biological warfare on cities, regions and even the entire planet. This prospect suggests the ultimate emerging infection.

Emerging infections, naturally occurring or otherwise, pose well-documented challenges to force protection. Whether it be pandemic influenza, untreatable forms of malaria or the anxiety associated with potentially infectious, ill-defined postwar syndromes, a proactive, anticipatory strategy is essential. The problem of emerging infections is global, reaching beyond the resources of any military organization or any single nation. A responsible assessment indicates that national and global security requires a robust early warning system for emerging infections. Partnerships among military organizations, federal and state agencies, and national and international groups are integral to a proactive strategy because they leverage limited resources and provide access to information needed for force protection and national security.¹⁷ **MR**

NOTES

1. A.T. Price-Smith, "Contagion and Chaos: Infectious Disease and its Effects on Global Security and Development," Working Paper (Center for International Studies, University of Toronto, Canada, 1997).

2. R.L. Guerrant, "Why America Must Care About Tropical Medicine: Threats to Global Health and Security from Tropical Infectious Diseases," *American Journal of Tropical Medicine and Hygiene* 59 (1998), 3-16.

3. W.J. Perry, "A Pragmatic US-Russian Partnership," Prepared remarks by Secretary of Defense William J. Perry to the military academy of the Russian general staff, Moscow, Russia, 17 October 1996, *Defense Issues* volume 11, 97.

4. William H. McNeill, *Plagues and Peoples*, (Toronto, Canada: Doubleday, 1976).

5. Institute of Medicine, "Emerging Infections: Microbial Threats to Health in the United States" (Washington, DC: National Academy Press, 1992).

6. A.T. Price, "Contagion and Chaos: Infectious Disease and its Effects on Global Security and Development."

7. B.L. Smoak, R.F. DeFrait, A.J. Magill, et al., "Plasmodium vivax infections in US Army troops: failure of primaquine to prevent relapses in studies from Somalia," *American Journal of Tropical Medicine and Hygiene* 56 (1997), 231-234.

8. Centers for Disease Control and Prevention, "Isolation of avian influenza A (H5N1) viruses from humans-Hong Kong," *MMWR* 46 (1998), 52 and 53.

9. R. Collier R., *The Plague of the Spanish Lady: The Influenza Pandemic of 1918-1919*, (London, England: Allison & Busby, Ltd, 1974); and A.W. Crosby,

Epidemic and Peace, 1918 (Westport CT: Greenwood Press, 1976).

10. M.B.A. Oldstone, *Viruses, Plagues, and History* (New York, Oxford University Press, 1996).

11. Laurie Garret, *The Coming Plague* (New York: Farrar, Strauss, and Giroux, 1994); and Centers for Disease Control and Prevention, *Addressing Emerging Infectious Disease Threats II: Entering the 21st Century* (Atlanta, GA: US Department of Health and Human Services, Public Health Service, 1998).

12. Centers for Disease Control and Prevention, *Addressing Emerging Infectious Disease Threats II: Entering the 21st Century*.

13. Centers for Disease Control and Prevention, "Isolation of avian influenza A (H5N1) viruses from humans-Hong Kong"; and Laurie Garret, *The Coming Plague*.

14. Centers for Disease Control and Prevention, *Addressing Emerging Infectious Disease Threats II: Entering the 21st Century*.

15. Global AIDS Policy Coalition, *Status and Trends of the HIV/AIDS Pandemic as of January* (Boston, MA: Harvard School of Public Health, 1996).

16. *A National Security Policy Strategy of Engagement and Enlargement* (Washington, D.C.: US Government Printing Office, February 1996).

17. Al Gore, "Emerging Infections Threaten National and Global Security," *ASM News* 62(9), 448-449; and Presidential Decision Directive NTSC-7, "Emerging Infectious Diseases," (Washington DC: White House, June 1996).

18. R.L. Guerrant, "Why America Must Care About Tropical Medicine: Threats to Global Health and Security from Tropical Infectious Diseases," 3-16.

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